Towards an improved understanding of the global hydrological cycle with SWOT

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Context (« big picture »):

A need for improved understanding of the global water cycle ➔ necessary for improved prediction

• Need for improved large scale monitoring ➔ Many large scale basins are poorly monitored: this is especially true in regions where freshwater resources are limited, population pressure is increasing, tans-boundary issues apply…

• Improved representation of hydrological processes (physics and parameters) at the global scale for fully coupled earth system models (seasonal forecast, climate scenarios-IPCC…)

• Main strategy for model improvement is to evaluate and develop physics at high resolutions (individual well instrumented basins, e.g. Garonne) or using data from field campaigns (e.g. Air SWOT), then extend these developments to other basins, larger scales (again, with the help of remotely sensed data, models, a combination of the two-via data assimilation)

• Develop models which can be used for developing/testing adequate climate change mitigation strategies (water resource management, crop adaptation…), potentially explore feedbacks with fully coupled earth system models

Specific Objectives and Approach:

Regional scale:

- Cooperation with Mines-Paris Tech on the development of MODCOU : transfer of the new module for river routing able to simulate water levels and dams ➔ validation of the new river routing with ***AirSWOT*** on the Garonne river.

- Further development of the river water level module (Manning vs calibration curves) and validation with operational data (Banque HYDRO)

- Calibration of the dam module and assessment of the aquifer impact on water levels, coupling with irrigation consumption (Contribution to RTRA action « TEREAU »)

- Preparation of ***AirSWOT*** design using MODCOU (collaboration with LEGOS, IMFT/IMT, Sisyphe, CERFACS)

Global scale:

- Improvement of *WL*, *Q*, *F* (flood coverage) and storage anomalies, Attempt to improve the simulations, test new physics (regional to global scale transfer)

- Orbit sub-cycles: explore issues for multiple contrasting large scale river basins (with LEGOS)

- Attempt to optimize (using data assimilation) more model parameters (TRIP & ISBA: e.g. Spatially distributed Manning cf as opposed to geomorphological relationships, possibly LSM parameters also: with LEGOS, CERFACS)

- Take into account other forcing errors (precipitation…), use a more ***realistic SWOT simulator***-with LEGOS, JPL

- Extend the methodology to other large basins (CDD-TOSCA) towards global scale applications

Link with key Phase-A SWOT issues:

Phase-A issues to be addressed:

(3) How often must a certain location be sampled? ➔ address this issue for mutliple contrasting (climate, latitude, geomorphology, snow cover/permafrost, vegetation..) large scale basins

(6) How will discharge and storage change be characterized and/or validated? ➔ using different remotely sensed + observed data, assimilation, SWOT simulator

(7) Can we further hone the SWOT hydrologic science questions? Can these be articulated in a way that more directly relates to the SWOT measurables, and at the same time, be made easily understood by a larger audience? Keep in mind that the strength of SWOT is its global reach. What is missing in our hydrologic knowledge at these large scales and how can this be used to further design the mission? question to be addressed via a multi-scale hydrological modeling (local, regional, global models, coop. with LEGOS) over some well known regions (e.g. SW of France).